Chapter 13: Reproduction

Knowledge organiser

Types of reproduction

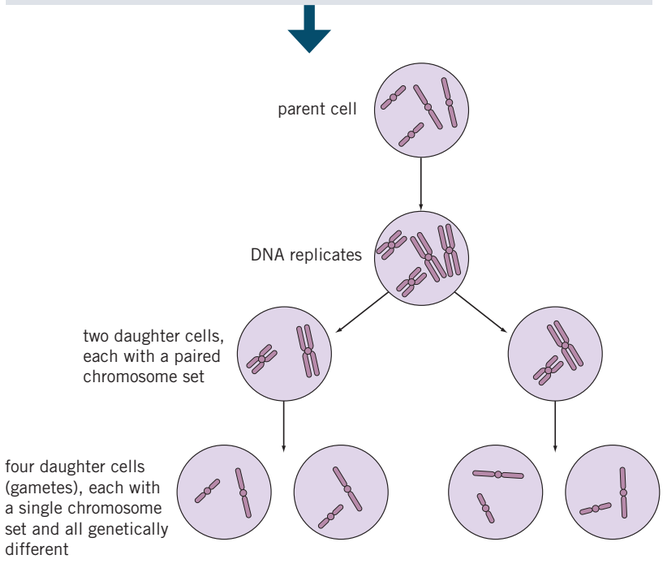
Sexual reproduction	Asexual reproduction
two parents	one parent
cell division through **meiosis**	cell division through **mitosis**
joining (fusion) of male and female sex cells (**gametes**) – sperm and egg in animals, pollen and ovule in plants	no fusion of gametes
produces non-identical offspring that are genetically different to parents	produces offspring that are genetically identical to parent (**clones**)
results in wide variation within offspring and species	no mixing of genetic information

Meiosis

Meiosis is a type of cell division that makes gametes in the reproductive organs.

Meiosis halves the number of chromosomes in gametes, and **fertilisation** (joining of two gametes) restores the full number of chromosomes.

The fertilised cell divides by mitosis, producing more cells. As the embryo develops, the cells differentiate.



DNA and the genome

Genetic material in the nucleus of a cell is composed of **DNA**.

DNA is made up of two strands forming a **double helix**.

DNA is contained in structures called **chromosomes**.

A **gene** is a small section of DNA on a chromosome that codes for a specific sequence of amino acids, to produce a specific protein.

The **genome** of an organism is the entire genetic material of that organism.

The whole human genome has been studied, and this has allowed scientists to

- search for genes linked to different diseases
- understand and treat inherited disorders
- trace human migration patterns from the past.

Inherited disorders

Some disorders are due to the inheritance of certain alleles:

- Polydactyly (extra fingers or toes) is caused by a **dominant** allele.
- Cystic fibrosis (a disorder of cell membranes) is caused by a **recessive** allele.

Embryo screening and gene therapy may alleviate suffering from these disorders, but there are ethical issues surrounding their use.

Genetic inheritance

gamete	specialised sex cell formed by meiosis
chromosome	long molecule made from DNA found in the nucleus of cells
gene	sequence of DNA that codes for a protein – some characteristics are controlled by a single gene (e.g., fur colour in mice and red-green colour-blindness in humans), but most are controlled by multiple genes interacting
allele	different forms of the same gene
dominant	allele that only needs one copy present to be expressed (it is always expressed)
recessive	allele that needs two copies present to be expressed
homozygous	when an individual carries two copies of the same allele for a trait
heterozygous	when an individual carries two different alleles for a trait
genotype	combination of alleles an individual has
phenotype	physical expression of the genotype – the characteristic shown

Genetic crosses

A **genetic cross** is when you consider the offspring that might result from two known parents. **Punnett squares** can be used to predict the outcome of a genetic cross, for both the genotypes the offspring might have and their phenotypes.

For example, the cross bb (brown fur) × BB (black fur) in mice:

		mother	
		B	**B**
father	**b**	Bb	Bb
	b	Bb	Bb

offspring genotype: 100 % Bb

offspring phenotype: all black fur (B is dominant)

Sex determination

Normal human body cells contain 23 pairs of chromosomes – one of these pairs determines the sex of the offspring.

In human females the sex chromosomes are the same (XX, homozygous), and in males they are different (XY, heterozygous).

A Punnett square can be used to determine the probability of offspring being male or female. The probability is always 50 % in humans as there are two XX outcomes and two XY outcomes.

		mother	
		X	**X**
father	**X**	XX	XX
	Y	XY	XY

Key terms

Make sure you can write a definition for these key terms.

allele *chromosome* *clone* *DNA* *dominant* *double helix* *fertilisation* *gamete* *gene* *genetic cross* *genome* *genotype* *heterozygous* *homozygous* *meiosis* *mitosis* *phenotype* *Punnett square* *recessive*

Chapter 13: Reproduction

Retrieval questions

Learn the answers to the questions below, then cover the answers column with a piece of paper and write as many as you can. Check and repeat.

	B13 questions	Answers
1	What is sexual reproduction?	joining (fusion) of male and female gametes
2	What type of cell division is involved in sexual reproduction?	meiosis
3	What type of cell division is involved in asexual reproduction?	mitosis
4	What is meiosis?	cell division that produces four daughter cells (gametes), each with a single set of chromosomes
5	What are the male and female sex chromosomes in humans?	• XX – female • XY – male
6	What are the male and female gametes in flowering plants?	• pollen – male gamete • ovule – female gamete
7	What is the genetic material in cells called?	DNA
8	What is the structure of DNA?	two complementary strands forming a double helix
9	What is a gene?	small section of DNA that codes for a particular amino acid sequence, to make a specific protein
10	What are alleles?	different forms of the same gene
11	What is a recessive allele?	allele that needs to be present twice to be expressed
12	What is a dominant allele?	allele that is always expressed, even if only one copy is present
13	What is a genome?	the entire genetic material of an organism
14	Define the term homozygous.	two of the same alleles present in an organism
15	Define the term heterozygous.	two different alleles present in an organism
16	What type of allele causes polydactyly?	dominant allele
17	What type of allele causes cystic fibrosis?	recessive allele
18	How many chromosomes do normal human body cells have?	23 pairs (46)
19	Why is studying the human genome important?	• search for genes linked to certain diseases • understanding and treatment of inherited disorders • tracing past human migration

Put paper here